Appendix B: Clean Version of Substitute Specification

WARP KNIT HAVING AN EXCELLENT TOUCH, AND A PROCESS OF PREPARING THE SAME

FIELD OF THE INVENTION

The present invention relates to a warp knit having excellent touch and a process of preparing such a warp knit.

More particularly, the present invention relates to a warp knit with softness and draping property due to its very fine structure and thus useful for materials of artificial leathers or ladies' clothes, and a process of preparing such a warp knit.

BACKGROUND OF THE INVENTION

If fiber becomes fine, its bending strength becomes weakened. Accordingly, since fabrics produced with ultra fine fiber have very soft touch, researches in connection with producing such ultra fine fiber on a commercial scale are developing very actively. Also, development of the technology capable of producing extremely fine synthetic yarn leads to great improvement of the value of the goods of sensitive materials for clothes.

Generally, the process of preparing ultra fine fiber is divided into three processes: a direct spinning process; a two-component division type spinning process; and a two-component extraction type spinning process. In the direct spinning process, it is possible to prepare ultra fine fiber of 0.3 to about 0.5 denier. In the two component division type spinning process, it is possible to prepare ultra fine fiber of 0.2 denier. In the two component extraction type spinning process, it is possible to prepare ultra fine fiber of 0.01 denier or less.

When ultra fine fiber prepared by means of the direct spinning process is applied to a warp knit, warping property and appearance of the warp knit is very poor since numerous filaments are scattered. Furthermore, the warp knit thus prepared is very inferior to touch and writing effect.

When ultra fine fiber prepared by means of the two components division type composite spinning process consisting of nylon/polyester is applied to a warp knit, warping property and knitting property of the warp knit is very poor since the nylon is isolated from the polyester by means of the tension and friction in warping and knitting. Furthermore, appearance of the prepared product is very poor due to limit of the denier of the ultra fine fiber.

When the composite fiber of 0.05 denier or less prepared by means of the two components extraction type spinning process is applied to a warp knit, warping property, knitting property and touch of the warp knit are good; however, density in the structure of the warp knit is loosened and thus appearance of the warp knit is poor since the extraction component is extracted at the following processing step for producing the ultra fine fiber.

Producing goods with ultra fine fiber is developing in variety in connection with textile applications. However, producing goods with ultra fine fiber is not developing in connection with knitting applications since the poor warping property and the several drawbacks generated at processing step as mentioned above.

Accordingly, it is an object of the present invention to prepare a warp knit, which has excellent touch, shape stability, and appearance, and thus is suitable for materials of ladies' clothes, with good warping property and knitting property.

SUMMARY OF THE INVENTION

The present invention provides a warp knit which has excellent touch, shape stability, flexibility, and appearance, and thus is suitable for materials of ladies' clothes. The present invention also provides a process of preparing such a warp knit with good warping property and knitting property.

More particularly, the present invention relates to a warp knit having excellent touch, consist of a front surface ply and a rear surface ply, the front surface ply consisting of ultra fine yarn with mono-filament denier of 0.01 to about 0.9 denier, the rear surface ply consisting of synthetic yarn or high shrinkage yarn with mono-filament denier of 1 to about 5

denier, wherein the recovery rate of elongation in the directions of wale and course is 8 to about 30 %.

The present invention also relates to a process of preparing a warp knit having excellent touch, characterized by knitting a warp knit by using a composite fiber consisting of a fiber formation component of 0.01 to about 0.9 denier and an extraction component as a yarn of the front surface ply, and a synthetic yarn or high shrinkage yarn with monofilament of 1 to about 5 denier as a yarn of a rear surface ply, and then raising the warp knit until the shrinkage rate of the warp knit has reached 40% or more, and then pre-heating, extracting the extraction component from the composite fiber, dyeing, buffing, and finally heating the warp knit continuously.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a graph showing recovery rate of elongation of a warp knit measured using an Instron in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The inventors of the present application accomplished the present invention by taking notice of the fact that the selection and the combination of the materials in designing the structure of the fabric is very important in order to prepare polyester warp knit which is as soft as natural suede and which has excellent appearance as well as excellent warping property and knitting property.

First of all, the present invention uses a composite fiber consisting of fiber forming components of 0.01 to about 0.9 denier and an extraction component as a yarn of the front surface ply. If the extraction component is removed from the composite fiber, the fiber-forming component with monofilament denier of 0.01 to about 0.9 denier is only left. If the monofilament denier of the yarn at the front surface ply is more than 0.9 denier, its soft touch

is poor and the writing effect is not revealed. If the monofilament denier of the yarn at the front surface ply is less than 0.01 denier, its soft touch is maintained, but its appearance is poor since the raised fibers are omitted or entangled due to friction.

It is preferable that the density of the yarn at the front surface ply is increased in order to improve the touch of the warp knit. It is possible for increasing the density of the yarn at the front surface ply to reduce the content of the extraction component in the composite fiber during the manufacturing stage; however, it is curbed technically in the spinning process, and there are limitations to increasing the density thereof even if the content of the extraction component in the composite fiber is reduced.

The content of the extraction component in the composite fiber is generally 20 to about 40 % by weight.

Accordingly, it is more preferable for increasing the density of fiber at the front surface ply to use high shrinkage yarn as a yarn of the rear surface ply.

It is preferable that polyester is used as the fiber- forming component and copolyester with excellent alkali hydrolysis property is used as the extraction component of the composite fiber used as yarn of the front surface ply.

Next, synthetic yarn or high shrinkage yarn with monofilament denier of 1 to about 5 denier is used as the yarn of the rear surface ply. If the monofilament denier of the yarn at the rear surface ply is less than 1 denier, draping property of the warp knit is decreased. If the monofilament denier of the yarn at the rear surface ply is more than 5 denier, warping property and knitting property of the warp knit are deteriorated.

The high shrinkage yarn, which is used as the yarn of the rear surface ply, preferably has the shrinkage rate in boiling water of 15 to about 50 % and the stress of the heat shrinkage of 0.2 grams/denier or more. If the shrinkage rate in boiling water is less than 15 %, it is not possible to increase the density of ultra fine yarn, which is the yarn of the front surface ply, and thus the touch is poor since the shrinkage is extremely low. If the shrinkage rate of boiling water is more than 50 %, it is possible to increase the density of ultra fine yarn, which is the yarn of the front surface ply; however, it is hard to control the process width of

the finished warp knit since the shrinkage is extremely high. Furthermore, if the stress of the heat shrinkage is less than 0.2 grams/denier, the stress between the structural points is not overcome even if the shrinkage rate in boiling water is high, and therefore sufficient shrinkage is not provided.

Copolyester is preferably used as the high shrinkage yarn as mentioned above. Co-polymer components include bisphenol-A, polyethyleneglycol, isophthalic acid or the like. However, the present invention is not limited to the co-polymer components as described above.

Also, the present invention uses a synthetic yarn with monofilament denier of 1 to about 5 denier as a yarn of the rear surface ply. The synthetic yarn is polyester filament or polyamide filament, more preferable polyester filament. If the monofilament denier of the yarn at the rear surface ply is less than 1 denier, it is impossible to add proper repulsion to warp knit. If the monofilament denier of the yarn at the rear surface ply is more than 5 denier, the process of warping and knitting are difficult, and touch of the warp knit is deteriorated because repulsion of warp knit is increased too much.

The content of yarn of the rear surface ply when it is knitted is preferably 15 to about 60 % in weight of the total weight of the processed warp knit. If the content of the yarn at the rear surface ply is less than 15% in weight, draping property is deteriorated. If the content of the yarn at the rear surface ply more than 60% in weight, the touch is deteriorated.

The content of the yarn of the front surface ply when it is knitted is preferably 40 to about 85 % by weight of the total weight of the processed warp knit. If the content of the yarn of the front surface ply is less than 40 % in weight, the touch of the warp knit is poor. If the content of the yarn of the front surface ply is more than 85 % in weight, the draping property and the mechanical property of the warp knit is deteriorated.

The present invention is characterized in that such a raw warp knit as mentioned above is raised so that the shrinkage rate of the raw warp knit is 40 % or more before preliminary heat treatment of the raw warp knit. After the raw warp knit is raised according to the present invention, it is preliminarily heat-treated as usual, and it is treated in alkali

solution, thereby the extraction component is removed from the composite fiber. After that, the warp knit is dyed, buffered and finally heat-treated.

As the present invention uses the extraction type composite fiber as the yarn of the front surface ply, the warping and knitting property is excellent. And as the extraction component of composite fiber is extracted in after-process, the yarn of the front surface ply is fined. As a result, the warp knit of the present invention has excellent touch and writing effect.

Meanwhile the warp knit of the present invention is composed densely out of ultra fine yarn with monofilament denier of 0.01 to about 0.9 denier, whereby its touch and appearance are very excellent. Especially, as the warp knit of the present invention includes the rear surface ply consisting of high shrinkage yarn with 15 to about 50% of shrinkage rate in boiling water, the density of the ultra fine yarn at the front surface ply is higher, and recovery rate of elongation of a warp knit in the directions of the wale and the course is 8 to about 30 %, which represents excellence. Also, as the warp knit of the present invention includes 15 to about 60% in weight of the rear surface ply consisting of the high shrinkage yarn, the touch and the draping property of the warp knit are excellent.

Also, the warp knit of the present invention, using the synthetic yarn with proper denier as the yarn of the rear surface ply, can solve the problem of the touch of warp knit prepared by two component extraction fiber being too soft. And the above-mentioned warp knit has excellent draping property and raising property.

As described in detail above, the warp knit of the present invention has excellent touch, appearance, and draping property, and thus it is suitable for materials of ladies' clothes or materials of artificial leathers.

The properties of the warp knit according to the present invention are evaluated as follows:

Softness

Softness of the warp knit is evaluated from sensitive examination by ten specialists. If more than eight specialists determine that the warp knit is soft, it is excellent. If five to about

seven specialists determine that the warp knit is soft, it is ordinary. If more than eight specialists determine that the warp knit is not soft, it is poor.

Draping property

Draping property of the warp knit is evaluated from sensitive examination by ten specialists. If more than eight specialists determine that the warp knit has draping property, it is excellent. If five to about seven specialists determine that the warp knit has draping property, it is ordinary. If more than eight specialists determine that the warp knit has poor draping property, it is poor.

Writing effect

Writing effect of the warp knit is evaluated from sensitive examination by ten specialists. If more than eight specialists determine that the warp knit has writing effect, it is excellent. If five to about seven specialists determine that the warp knit has writing effect, it is ordinary. If more than eight specialists determine that the warp knit has poor writing effect, it is poor.

Appearance

Appearance of the warp knit is evaluated from sensitive examination by ten specialists. If more than eight specialists determine that the warp knit has good appearance, it is excellent. If five to about seven specialists determine that the warp knit has good appearance, it is ordinary. If more than eight specialists determine that the warp knit has poor appearance, it is poor.

Shrinkage rate of boiling water

Shrinkage rate of boiling water is measured according to JIS-L-1073 methods.

Recovery rate of elongation (%)

Total measurement is carried out according to KSK 08125, but proper elongation length when being elongated at the constant velocity is output by using JIS L 1096. Both ends of a sample of the warp knit with length of 10 cm and width of 15 cm are fixed to Instron. The warp knit is elongated constantly at the stretching velocity of 100 mm/min until the load of 750 g is reached. The warp knit is left as it is with the load being removed. Next, the warp

knit is elongated at the constant velocity up to the original position. And then, the warp knit is left as it is for three minutes with the load being removed. The above process is repeatedly carried out five times. Finally, the elongated length L and the free elongated length L_1 are measured. The free elongated length L_1 is obtained by subtraction of the length measured after the warp knit is left as it is from the elongated length L (See Fig. 1). The recovery rate of elongation is obtained by putting the elongated length (L) and the free elongated length (L_1) in the following equation:

Recovery rate of elongation (%) = [elongated length (L) - free elongated length (L_1)]/elongated length (L) × 100

Warping property

Warping property is evaluated by checking the stop times/hour of warping machine due to yarn defect. If the stop times/hour is naught, it is excellent. If the stop times/hour is one or two, it is ordinary. If the stop times/hour is more than 3 times, it is poor. The stop times/hour of warping machine is calculated by dividing the total stop times of warping machine in warping the yarn of 9kg into total warping time.

Knitting property

Knitting property is evaluated by checking the stop times/hour of knitting machine due to yarn defect. If the stop times/hour is naught, it is excellent. If the stop times/hour is one or two, it is ordinary. If the stop times/hour is more than 3 times, it is poor. The stop times/hour of knitting machine is calculated by dividing the total stop times of knitting machine in a day into 24hour.

Raising property

Raising property of warp knit is evaluated from sensitive examination. If the raising of warp knit is finished well by passing through the raising machine 8 times at speed of 15m/minute, it is excellent. If the raising of warp knit is finished well by passing through the raising machine 10 times at speed of 15m/minute, it is ordinary. If the raising of warp knit is finished well by passing through the raising machine more then 10 times at speed of 15m/minute, it is poor.

The present invention is now understood more concretely by comparison between examples of the present invention and comparative examples. However, the present invention is not limited to such examples.

Example 1

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole% of dimethylene sulfurisophthalic sodium, and which is used to prepar 0.05 denier of ultra fine yarn after removing the extraction component, and is used as a yarn of the front surface ply, and then using copolyester yarn with mono filament of 5 denier and shrinkage rate in boiling water of 28% (high shrinkage yarn) as a yarn of the rear surface ply. At this time, content of the yarn of the rear surface ply is 26% in weight to the total weight of processed warp knit. Next, treat the manufactured raw warp knit with raising machine until the shrinkage of the warp knit has reached 50%. And then, after heating the warp knit at 190 ^{0}C preliminarily, dipping the warp knit in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above mentioned warp knit. And then, the properties of the processed warp knit are evaluated using the above-mentioned methods. The results of the evaluation are shown in Table 1.

Example 2

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7

mole% of dimethylene sulfurisophthalic sodium, and which is used to prepare 0.07 denier of ultra fine yarn after removing the extraction component, and is used as a yarn of the front surface ply, and then using copolyester yarn with monofilament of 3 denier and shrinkage rate in boiling water of 34% (high shrinkage yarn) as a yarn of the rear surface ply. At this time, the content of the yarn of the rear surface ply is 31% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 55%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above-mentioned warp knit. And then, the properties of the processed warp knit is evaluated using the above-mentioned methods. The results of the evaluation are shown in Table 1.

Example 3

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole% of dimethylene sulfurisophthalic sodium, and which is used to prepare 0.04 denier of ultra fine yarn after removing the extraction component, and used as a yarn of the front surface ply, and then using copolyester yarn with monofilament of 2.5 denier and shrinkage rate in boiling water of 28% (high shrinkage yarn) as a yarn of the rear surface ply. At this time, content of the yarn of the rear surface ply is 55% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 50%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at

180 ^{0}C to finally obtain the above-mentioned warp knit. And then, the properties of the processed warp knit are evaluated as above-mentioned methods. The results of the evaluation are shown in Table 1.

Example 4

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole% of dimethylene sulfurisophthalic sodium, and which is used to prepare 0.2 denier of ultra fine yarn after removing the extraction component, and used as a yarn of the front surface ply, and then using copolyester yarn with monofilament of 5 denier and shrinkage rate in boiling water of 28% (high shrinkage yarn) as a yarn of the rear surface ply. At this time, content of the yarn of the rear surface ply is 26% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 55%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above mentioned warp knit. And then, the properties of the processed warp knit are evaluated as in the above-mentioned methods. The results of the evaluation are shown in Table 1.

Comparative Example 1

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole% of dimethylene sulfurisophthalic sodium, and which is used to prepare 0.05 denier of ultra fine yarn after removing the extraction component, and used as a yarn of the front

surface ply, and then using copolyester yarn with monofilament of 0.5 denier and shrinkage rate in boiling water of 40% (high shrinkage yarn) as a yarn of the rear surface ply. At this time, the content of the yarn of the rear surface ply is 48% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 50%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above-mentioned warp knit. And then, the properties of the processed warp knit are evaluated as in the above-mentioned methods. The results of the evaluation are shown in Table 1.

Comparative Example 2

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole% of dimethylene sulfurisophthalic sodium, and which is used to prepare 0.05 denier of ultra fine yarn after removing the extraction component, and used as the yarn of the front surface ply, and then using polyester yarn with monofilament of 20 denier as the yarn of the rear surface ply. At this time, content of the yarn of the rear surface ply is 42% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 50%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing (with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above mentioned warp knit. And then, the properties of the processed warp knit are evaluated as in the above-mentioned methods. The results of the evaluation are shown in Table 1.

Comparative Example 3

At first, the raw warp knit with density of 23 course/centimeter is prepared by using an extraction type composite fiber, in which the fiber forming component is polyethyleneterephtalate and the extraction component is copolyester copolymerized with 7 mole % of dimethylene sulfurisophthalic sodium, and which is used to prepar 1.3 denier of ultra fine yarn after removing the extraction component, and used as the yarn of the front surface ply, and then using polyester yarn with monofilament of 20 denier as the yarn of the rear surface ply. At this time, the content of the yarn of the rear surface ply is 42% in weight to the total weight of processed warp knit. Next, the manufactured raw warp knit is treated with a raising machine until the shrinkage of the warp knit has reached 50%. And then, after heating the warp knit at 190 ^{0}C preliminarily, the warp knit is dipped in NaOH solution (1% concentration) for 30 minutes at 98 ^{0}C in order to remove the extraction component of the composite fiber. And then a processed warp knit is prepared by dyeing with disperse dyes), buffing and heating at 180 ^{0}C to finally obtain the above-mentioned warp knit. And then, the properties of the processed warp knit are evaluated as in the above-mentioned methods. The results of the evaluation are shown in Table 1.

Comparative Example 4

Except for using the ultra fine polyester yarn with monofilament of 0.04 denier, made by direct spinning, as the yarn of the front surface ply, a warp knit is prepared by same process and condition as Example 1. And then, the properties of the processed warp knit are evaluated as in the above-mentioned methods. The results of the evaluation are shown in Table 1.

Table 1: Results of property evaluation of warp knit

Class		Example				Comparative example			
		1	2	3	4	1	2	3	4
Softeness		E	E	E	E	O	P	P	E
Draping property		E	E	E	O	P	E	O	O
Writing effect		E	E	E	E	E	P	P	P
Appearance		E	E	O	O	O	O	P	O
Warping property		E	E	E	E	E	E	O	P
Knitting property		E	E	E	E	O	E	E	P
Raising property		O	O	O	E	O	O	P	P
Recovery rate of elongation (%)	In the direction of wale	20.01	12.36	18.00	16.27	19.77	10.40	14.88	7.87
	In the direction of course	18.57	13.00	15.23	15.33	17.23	13.26	16.29	6.90

(The E means excellent, O means ordinary and P means poor in the Table 1)

As described above, the warp knit according to the present invention has excellent touch, appearance, shape stability rate, draping property, and thus is useful for materials of artificial leathers or ladies' clothes. Furthermore, the process of preparing such a warp knit according to the present invention gives the warp knit very excellent warping property and knitting property.